The Effects of Multiple Schematic Constraints on the Recall of Limericks

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Abstract

Traditional theories of text memory and comprehension posit that text is represented and reconstructed based upon its semantic content. In contrast, Rubin (1995) found that poetic materials are remembered based not only on semantic content, but based also on the schematic constraints, such as rhythm and rhyme, present in the surface structure of the verse. Rubin's research has done much to record the phenomenon of memory for poetic, structured materials. The present study is an investigation of the effects of multiple schematic constraints on participants' recall for words in limericks. This study provides support for Rubin's claims that surface structure and schematic constraints facilitate recall for schema-consistent poetic materials. In addition, the present study extends the analysis of the effects of schematic constraints, illustrating that the schematic constraints present in structured verse serve to guide recall for schema-inconsistent material, making the inconsistent material schema-consistent upon recall.

Introduction

Traditional theories of text memory and comprehension posit that text is represented and reconstructed based upon its meaning or gist (Bartlett, 1932; van Dijk & Kintsch, 1983). According to van Dijk and Kintsch (1983) there are three levels of representation for text and discourse in memory. At the surface level, information is represented by the exact words and phrases present in the text. At the second level, it is the semantic content of the text that is represented in memory. At the third level, it is not the text itself that is represented, but the situation described in the narrative. This level of representation is detached from the text structure and is embedded in pre-existing fields of knowledge. At this level, the text is organized and assimilated by the schemas already present in the mind. Thus, according to van Dijk and Kintsch's thesis, it is the semantic content that is extracted from a text and subsequently represented in memory. This theory is based upon the analysis of comprehension for materials that are themselves organized and constrained only by their meaning or narrative content. There is evidence to suggest that memory for structured, highly constrained text is based on more than a macro-level semantic representation (Kintsch, 1998; Rubin, 1995). Traditional theories have not given serious consideration to memory for poetic materials whose surface features and structural constraints may be as important to the reconstruction of such materials as is the gist of the material.

Rubin's (1995) analysis of memory in oral traditions investigated the recall of highly structured material. Rubin's results indicated that poetics aid in the reconstruction of song lyrics (Hyman & Rubin, 1990), epic ballads (Wallace & Rubin, 1991), and counting-out rhymes (Kelly & Rubin, 1988). Rubin viewed the structure of verse as a highly constrained situation in which rhyme, rhythm, and meaning combine to restrict the range of alternatives activated by the stimuli. According to Rubin (1995) these schematic constraints combine to add cue-item discriminability, increasing the amount recalled, and restricting the form of errors and variations in recall.

The constraining effects of schematic structures were illustrated by Hyman and Rubin's (1990) analysis of memory for lyrics from Beatles' songs. Consistent with schema theory, Hyman and Rubin found that recall errors fit the constraints present in the structure of Beatles' song lyrics. Errors in recall adhered to the rhythm, rhyme, and semantic structure of the songs. While this and similar studies provide a good description of the phenomenon, the findings are not free of ambiguity, and the effects of schematic constraints have not been fully investigated. The present study offers support for Rubin's theory, while extending the investigation of the effects of schematic constraints by utilizing materials that are schematically inconsistent.

The ambiguity of Hyman and Rubin's (1990) findings on memory for song lyrics is due to a lack of control over the stimuli. The investigators could not control for subjects' prior exposure to the Beatles' songs, which may have affected both the recall and perception of the song lyrics. Thus, the novelty of the stimuli utilized in the present study allows for clear demonstration that the form of recall errors is not due to errors in encoding, but due to the effects of schematic constraints which combine to guide the reconstruction of the verse in memory.

The present study extends the investigation of the effects of schematic constraints by utilizing materials that are schematically inconsistent. According to Rubin (1995), information is most accurately recalled when it fits the structural constraints, as in Hyman and Rubin's (1990) investigation of memory for song lyrics. Schema theory also predicts that when information violates structural constraints, participants will reconstruct the information to conform to the structure of the context. Thus, by including to-be-remembered materials that do not conform to limerick structure, this study may lead to more understanding of this additional feature of schema-guided recall.

Experiment 1 of the present study investigated participants' ability to predict words missing in limericks given the amount the words were constrained by the structure of the limerick. A limerick, with its set rhythm,

rhyme, and thematic structure, is a high-constraint context. The target words in the proposed investigation of recall errors are constrained by the limerick's strict rhyme and rhythm structure, and also by the narrative theme of the verse. According to Holman and Harmon (1992), limericks are made up of five lines of which the first, second, and fifth both rhyme and contain three anapestic feet (the unit of rhythm in verse) and the third and fourth lines, which rhyme and consist of two anapestic feet. The definite pattern of the limerick makes it an ideal medium in which to study the effects of multiple schematic constraints on memory. The consistent rhyme and rhythm pattern and the narrative semantic content combine to provide the maximum constraint for recollection as well as a schema of organization which serves to guide participants' recall of target words in Experiment 2 of this study.

Experiment 1 was a norming study. The data were collected in 1994 and analyzed as part of this investigation. Participants were instructed to generate the missing words for 100 limericks. The study was designed to investigate how multiple constraints aid in the prediction of words missing from limericks. A word was left out of each limerick in either the middle or at the end of one of the five lines. Half of the limericks have a word missing in the middle of a line, and half at the end of a line. There were ten blanks in each position for each of the five lines. Participants filled in the missing words and these responses were analyzed to determine whether there were differences caused by the position of the missing word in the limerick. It was hypothesized that there would be more correct predictions of target words for those limericks where the blank occurred at the end of a line. This hypothesis is based on the theory that constraints combine to restrict the range of response alternatives. The last word in a line of a limerick is constrained by rhyme as well as rhythm and meaning. However, words in the middle of a line in a limerick are constrained only by the meter and meaning of the verse. Thus, it was expected that there would be more accurate prediction for the blanks at the end of lines. The responses participants provided were used as alternates for the study packet in Experiment 2.

In Experiment 2, participants were presented with 50 limericks, some of which have the last word (target word) in one of the five lines altered to violate the rhyme, rhythm, semantic, or all three schematic constraints, and some which were not altered. Participants were asked to read the limericks and then were given a memory test in which they were asked to recall the target words.

Based upon traditional theories of the mental representation of text, one would predict the greatest number of recall errors for those target words that violate the semantic content of the limerick. A nonsense narrative would presumably hinder participants' ability to represent the limerick's gist in memory. Thus, according to the traditional theory, of the one-violation conditions, recall would be lowest for the meaning-violated condition.

It could be argued that the memory test in Experiment 2 amounts to little more than the prediction of the target words, as in Experiment 1. Perhaps the limericks in the study packet are not represented in memory, and participants merely fill in the blanks with likely words in the test packet. If this were the case, there should be very few schema-inconsistent target words recalled.

Based on the theory of multiple constraints, I hypothesize that the fewest recall errors and fewest schema inconsistent responses will occur in the condition where the limerick structure is not violated. I also predict that the condition where all three structural constraints are violated will produce the least accurate recall and the least structurally consistent responses. I expect that the number of errors and inconsistent responses for the one-constraint-violated conditions will be more than for the no-violation condition and less than for the all-constraints-violated condition. At this time, there is no theoretical basis for predicting differences among the three one-constraint-violated conditions. Based on schema theory, I hypothesize that participants will make recall errors which alter the missing word to fit the structure of the limerick. Recall errors will be schema-consistent.

Experiment 1: Prediction of Missing Words in Limericks

Methods

Participants Twenty-eight undergraduates participated in the study.

Materials and Procedures Participants received a packet containing 100 limericks. Participants then received instruction on limerick structure and an example. Each limerick contained a blank in the middle or the end of one of its five lines. There were ten limericks representing each of the ten positions. Participants were instructed to fill in the blank with the first word that came to mind, keeping in mind the rhyme, rhythm, and meaning patterns.

Results

The analysis of the data consisted of a 5 X 2 ANOVA with Tukey follow-up tests. The independent variables were as follows: Limerick *line* containing the blank (one; two; three; four; or five); and *position* of blank in the line (middle vs end). The dependent variable is the number of correct predictions.

The ANOVA revealed a significant difference in the number of correct predictions, $F(1, 108) = 923.688$, $MSE = 1.18$, $p < .05$, $\omega^2 = .73$, as a function of the position of the blank within the line. There were no significant differences in the number of correct predictions across the line of the limerick in which the blank occurred. There was an interaction between line and position, only in the fourth line, which was considered an artifact.

Experiment 2: Recall of Schema-Inconsistent Limericks

Methods

Participants Twenty (7 males and 13 females, mean age = 23.6) Western Washington University undergraduates

participated in the study.

Materials and Procedures Participants were given training in limerick structure and an example. They then received a study packet containing fifty limericks which were read by the participants individually. In the study packet, the last word of a line in each limerick was made to fit the five levels of the independent variable: Constraint Violated (original--no violations; rhyme; rhythm; meaning; and all). There were ten limericks for each level of the independent variable. The alterations were taken from participants' responses in Experiment 1. The alterations for each limerick were chosen at random with the restriction that there would be an equal number of limericks for each level of the independent variable. Participants were given twenty minutes to study this packet.

Participants then received a test packet containing the same limericks with blanks for the target words. The participants were instructed to fill in the blank with the target word for each limerick. No time limit was placed on the completion of the test packet.

Results

The analysis of the data consisted of a one-way ANOVA with Tukey follow-up tests. The independent variable was as follows: constraint violated (none; rhyme; rhythm; meaning; or all). The dependent variables were as follows: number of correct responses and proportion of incorrect responses that were consistent with schema structure. The first analysis tested the effects of the different violations on subjects' ability to recall the target word. As hypothesized, recall was significantly better for the no violation condition than for the others, $\underline{F}(4, 76) = 103.73$, $\underline{MSE} = 1.60$, $\underline{p} < .05$, $\omega^2 = .84$ (see Figure 1). Follow-up comparisons revealed that, contrary to prediction, there was a significant difference between the one-constraint conditions (M rhythm = 4.05; M meaning = 3.55; M rhyme = 2.70). Also, the rhyme-violated condition was not significantly different from the all-violations condition, while both the rhythm- and meaning-violated conditions were significantly different from the all-violations condition.

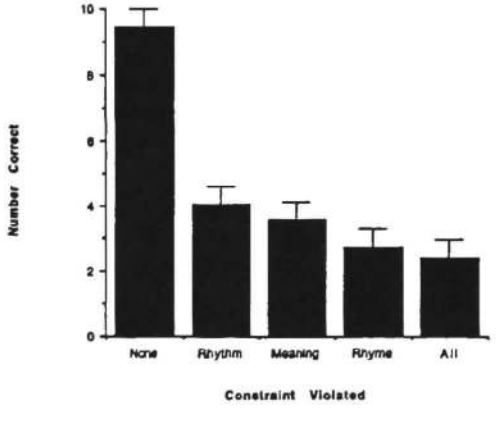

Figure 1: Number of correct responses as a function of the violation condition (n = 20). Error bars represent 95% confidence intervals calculated with the method prescribed by Loftus and Masson (1994).

In order to assess the degree to which subjects altered the to-be-remembered word such that it would be consistent with limerick structure, the proportion of incorrect but schema-consistent responses was analyzed across violation conditions. A response was deemed schema-consistent if it fit the rhyme, rhythm, and semantic structures of the given limerick. The results indicate a significant effect across conditions $\underline{F}(3, 57) = 9.83$, $\underline{MSE} = .021$ $p < .05$, $\omega^2 = .25$ (see Figure 2). Follow-up tests revealed significant differences among the one-violation conditions (M rhyme = .61; M meaning = .59; M rhythm = .50), and all one-violation conditions were significantly different from the all-violation condition (M all = .39).

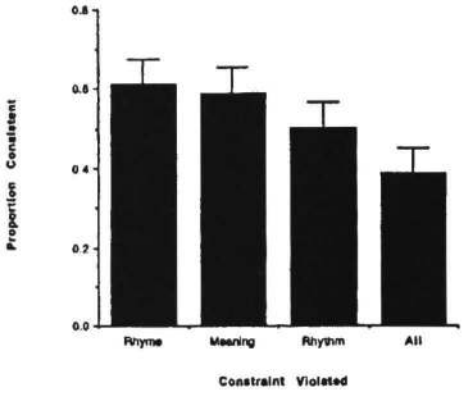

Figure 2: Proportion of errors which are consistent with limerick structure as a function of the violation condition (n = 20). Error bars represent 95% confidence intervals calculated with the method prescribed by Loftus and Masson (1994).

The proportion of incorrect-but-consistent responses was taken from the number of incorrect responses that were consistent with limerick structure divided by the total number of incorrect responses. There were so few incorrect responses in the no-violations condition that there were few values for this dependent variable in the no-violations condition. Thus the no-violations condition was not included in this analysis.

Discussion

In general, the results presented above indicate that poetics play a role in guiding and shaping memory for structured verse. The more closely a word fits the structure of the verse, the more accurately it is recalled. And when the word is not correctly recalled, it is often altered to fit the structure of the verse. These findings clearly support Rubin's (1995) claim that poetic structure guides recall. In addition, the experimental manipulation of violating the schematic constraints in the verse has made possible the prediction of where recall errors for words in structured verse will occur. The same constraints that combine to guide recall also shape the reconstruction of the to-be-remembered information. This allows for the prediction that when errors occur, they will be schema consistent. The structure of the verse guides the reconstruction of the missing word.

While the results of the present study support Rubin's (1995) theory of memory and verse, these findings seem at odds with the traditional theory that memory for text and discourse consists of a macro-level semantic representation. Rhyme and rhythm seem to have a central role in memory for structured verse. In the present study, violations of meaning did not hinder recall significantly more than the other one-constraint violation conditions. In fact, rhyme violations did decrease the number of target words recalled by a significant amount over both rhythm and meaning. This suggests that the rhyme schema is an important component organizing memory for limericks.

In his brief treatment of the topic, Kintsch (1998) illustrates that findings for the importance of surface level constraints can be generated utilizing his bottom-up Construction-Integration model. Kintsch claims that given the proper production rules, the model will show the importance of non-semantic components in the comprehension and organization of structured verse. Rubin (1995), however, prefers to view the situation as one in which the participant seeks to satisfy the schematic constraints of the structure, and seems not as concerned with the surface level of representation as is Kintsch in his model.

The results of the present study lend support to the idea that poetics and structure guide recall for verse. On a more general level, these findings support the theory that multiple constraints aid memory by making more stringent the criteria by which an alternative is considered to be the target information. And on an even more general level, these findings support schema theory, specifically, the idea that people's schema for a general event guide their recall for a specific event. However, discussion of the implications of this study must be tempered with the acknowledgment that there are limitations present in methodology, as well as issues concerning the generalizability of the findings.

While the present study has implications for many areas of research and application, it would be problematic, at this time, to generalize the findings to areas beyond the scope of the investigation. It may be that these findings cannot be generalized to all structured verse. It is likely that the relative importance of some constraint varies with its prevalence or complexity in the genre under investigation. For example, in the sonnet, the patterns of rhyme and rhythm are more complex than those in limericks. Perhaps in this condition, people would rely more on the semantic content of the sonnet to guide their recall than they do when provided a sing-song structure of rhythm and rhyme, like that present in limericks. Also, it is likely that the methodology employed in this study has not fully captured the effect of multiple constraints on memory for structured verse.

While it seems clear that the more a target word fits the constraint of the structure the better it will be recalled, it would be beneficial to include conditions in which two of the constraints were violated (i.e. meaning and rhyme violated, meaning and rhythm violated, and rhyme and rhythm violated). In this case, one would expect that recall for words in these conditions would be poorer than for the one-violation conditions and better than for the all-violations condition. Another benefit of including these conditions is that they would provide further indication of which constraints present in structured verse are most important to memory.

Future research should be designed with an eye to examining the effects of schematic structure and constraint in other genre of structured verse. It would also be beneficial to investigate the effects of two-violation conditions on recall for limericks. The inclusion of two-violation conditions should provide a better indication of the relationship between the effects of constraint on recall. It should also provide further indication of the extent to which specific constraints guide the recall for words missing from structured verse, and the degree to which each constraint is implicated in the mental representation of structured text.

The present study is potentially an important step toward understanding the relationship between schematic constraint and memory. It has been shown that schematic and structural constraints combine to aid memory for schema-consistent information. These same constraints guide the reconstruction of schema-inconsistent information, resulting in memory that is schema-consistent. In this way, the present study addresses the general topic of schema-consistent recall error, and more specifically, how schematic constraint influences the way information is recalled in structured verse.

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